HUMAN AD Heliprops

HELIcopter **PRO**fessional **P**ilots **S**afety Program
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Risk

Recently a construction worker in Atlanta, Georgia was rescued via helicopter from a tall crane boom that stood over a raging fire. The construction worker was stranded on the end of the crane boom when he was unable to descend before the fire beneath him grew to an inferno.

Two other helicopters made what were perhaps only exploratory efforts to hover/fly by to determine if they would be capable of doing the rescue. Each of these first two helicopters would only have been able to hover immediately adjacent to the worker at the end of the crane. The gusty wind, and steadily growing and intense heat from the fire were so great that these first two helicopters did not make serious attempts at the rescue.

A third helicopter's crew, which had more of an opportunity than the first two to plan and configure for the rescue, was then able to pluck the construction worker off the crane. This rescue, which was probably the only way to save the life of the construction worker in the short time allowed by the fire, was conducted by suspending a fireman beneath the helicopter on a long line and hovering high above the crane and fire. After being lowered onto the crane by the helicopter crew, the fireman made his way to the construction worker, strapped him into a harness, and then the two were maneuvered away from the fire and gently lowered to a safe place on the ground.

The goal to save the construction worker from certain death, as well as the danger posed by this immense fire, were each quite obvious.

Some of the other risks in each of the three efforts may not have been so apparent. It was not evident, for instance that the helicopter crew chief and the fireman had not previously worked with each other or practiced the contemplated rescue, and had only a few minutes to discuss the situation and plan their course of action.

What is Risk?

One way of defining risk is that it is the combination of, (1) the probability of an event occurring, and (2) the potential for loss or harm from that event.

Probability can, for some events, be calculated and expressed mathematically. The probability of rolling any number with one roll of a dice is one in six. The Texas Lottery is won by choosing the same 6 numbers drawn from 50 numbers. With enough effort, this lottery probability can be calculated.

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The history of aviation occurrences, such as the number of U.S. General Aviation fatal helicopter accidents per one hour of flight, can be calculated if one has access to all of the data necessary for such a calculation. The probability for future fatal accidents can be inferred from such historical data.

The other portion of risk - Potential for loss or harm from any particular event occurring - is much more complicated and difficult to quantify. A determination of the potential for loss or harm may require many factors to be considered; and, in a dynamic, time-constrained situation the alternatives for action may change every few seconds.

Determining risk, which is the combination of probability and potential for loss or harm, is often not a simple process.

What must be considered?

In the aviation world it is generally agreed that there are four elements that must be considered in assessing risk. These are, (1) the Aircraft/Equipment used to do the job, (2) the Pilots and Crew who are involved, (3) the Environment or Situation where the work is planned and performed, and (4) the Mission or Activity that is undertaken.

* Pilots/Crew

Pilots are not all alike. Even those who have similar backgrounds, training, and experience will not do things in the same manner. Some are, for various reasons, more competent than others. Consequently, with various levels of competence, pilots pose various levels of risk.

Throughout the history of aviation we have experienced countless incidents and accidents that are caused by some human error. Statistics show that most accidents are due to pilot error. Pilots are certainly not perfect, but neither are the various individuals who are involved with helicopter operations. Helicopter operations have many people who can loosely be considered "crewmembers." They perform their function in and around the helicopter, and are necessary participants in specific operations. Observers, crew chiefs, hoist operators, rescue swimmers, medical personnel, photographers, as well as many others, are part of the action. These "crewmembers" must also be considered for the risk they bring to the equation.

* Aircraft/Equipment

The aircraft and mission equipment, just like humans, have their own performance, features, and characteristics. One specific type of helicopter may be better suited to perform a particular job than another. For example, an AS 350 is superior to an R-22 for transferring six passengers; and a CH-47 would be superior to the AS-350 to haul 24 combat troops; but the R-22 would be better than the CH-47 for basic flight training.

An aircraft's capabilities can be expressed in technical terms and shown in charts and tables. Data such as Hover-out-of-ground-effect charts, Height-Velocity Diagrams, and Critical Winds Azimuth charts quantify an aircraft's ability to perform missions. Like humans, aircraft systems are subject to misuse, malfunction, or failure. Whether operating normally or otherwise, the aircraft and equipment contribute their portion to the total risk.

* Environment/ Atmosphere

The natural environment has always been a significant factor in aviation. When the weather is benign, the flying can be a joy. But we all know that weather can be a direct and life threatening force that cannot be ignored. The risks posed by heavy weather - squall lines, hail, tornadoes, hurricanes, freezing rain, and fog - are ordinarily obvious and so too are the decisions to fly or not to fly. The risks involved in other natural conditions may not be so obvious. Hot/humid conditions can cause crew heat stress, as well as negatively affect an aircraft's performance. Severe cold temperature will affect a mechanics ability to work out-of-doors, and can make engine battery starts difficult or impossible. An offshore night flight without the benefit of the moon or stars can lead directly to a pilot experiencing spatial disorientation.

The manmade environment has its contribution to the total risk too. Unmarked wires, newly erected antennas, and construction around heliports are traps awaiting low flying helicopters. Other things, simple things like the work schedule, or the office/hangar/working/sleeping facilities, or the attitude of superiors and peers can make a pilot hate his work and consequently affect his judgement and decisions. Both the natural and the manmade environment must be analyzed for the risks they present.

* Missions/Activity

Every type of helicopter operation faces some common risks. Essentially every pilot faces the potential of system malfunction, must consider the weather, and has some constraints such as the Height-Velocity Diagram.

Some operators have risks that are peculiar to their operation. Heli-skiing, fish-spotting, and aerial applications, for instance, each have their own problems and procedures.

Risk … pg. 2 cont'd.

How is Risk Determined?

In some organizations, including the U.S. Army, there is a formal, written pre-mission risk assessment that must be completed and approved before flight. The risk elements are analyzed and a numerical score is given to each element. If the risk assessment total score exceeds a limit, a higher authority must be consulted for approval. The higher the risk, the higher the approval level. This formal process also recognizes that the four risk elements Crew, Aircraft, Environment, and Mission are subject to change even during the course of a short flight. Crew may become fatigued or incapacitated; the aircraft performance may degrade; the weather abruptly change; or the crew diverted to a different mission. As any flight proceeds the crew is expected to be alert for changes and to make a continuous risk assessment.

Few organizations however, perform a formal, written, quantitative risk assessment. The process is ordinarily informal, and unwritten; it is usually performed solely by the pilot/crew; and it often considers the same four elements of risk.

This process results in a *qualitative* rather than a *quantitative* assessment of the total risk. There are no written numbers and total score in this informal procedure. Rather there is a qualitative determination that the risk is acceptable, or it is not. In many cases the decision is a "no-brainer." For example, if the weather is terrible you don't go. If it is OK you do. It's when the weather is marginal that the risk assessment is a bit more challenging and the go/no-go decision more difficult to make. These unwritten risk assessments may have more formality than is apparent. Risk assessment is institutionalized. If, for instance, the four risk elements fall within limits established by company policy and procedure, then the risk is considered acceptable.

Why is Risk Assessed?

Some may look at the pre-mission risk assessment procedure as a method designed solely to prevent pilots from doing their jobs. Prudence would say that risk assessment is a procedure that is designed to determine a reasonable way for a pilot to do his job safely.

Risk assessments find ways to eliminate, work around, or manage risks and still get the job done.

Regardless of the formality or completeness of the risk assessment process it is subject to some constraints and biases.

* Awareness

A person who is not aware of a situation, or who cannot recognize the danger in a situation is not well prepared to find a way to contain the risk. This lack of awareness can be as a result of simply not observing something that may be important; or it may be due to a lack of experience and knowledge to be able to understand the gravity of a situation.

* Time Available

During flight it is not unusual to experience a rapidly changing, dynamic, stress provoking situation. In such a state of anxiety a pilot may not have the luxury of unlimited time in which to analyze the situation, consider alternatives, and determine a reasonable course of action.

* Loss or Gain

Some risks are rejected because of the potential for a loss. A non-gambler wouldn't risk losing $100 to win $200, even if the odds of winning are fifty-fifty.

Some risks are accepted because of the potential for a gain. Many helicopter crews have risked their own lives for the chance to save the life of another.

Risk … pg. 3 cont'd.

* Sensitivity

It is natural for humans to address the factors that impose the greatest risk. This can result in either missing or ignoring the small stuff. Unfortunately, the small stuff can at times lead to serious errors.

* Personality Variables

As the trite saying goes, "Different strokes for different folks." Not everyone has the same tolerance to risk. What may be fun for one may be terror for another.

Some of these human limits and biases can partially explain why one pilot will accept a mission when another would flatly reject it.

Summary

In the Atlanta helicopter rescue described earlier in this article one can imagine the risk assessments that were accomplished. The first two helicopters did not make a serious rescue attempt probably because the crews determined that they were not prepared, the aircraft were not configured for the mission, and the effects of the fire and wind were beyond limits.

Conducting thorough and timely risk assessments is only part of the equation that leads to safe accomplishment of missions.

The other factors are the ***self discipline*** to follow through with the decisions that result from continuous risk assessments; and the ***assertiveness*** to be firm in the face of influences that challenge those decisions.

There I Was...

Here are accounts submitted to us by readers.

206B Sling Load

"Being a young pilot /A&P at the time, (850 hours total time on type) working on my second real season of flying, I was sent to do a job south of 70 degrees latitude on Victoria Island in Canada. Aircraft type was a Bell 206B. One of the side jobs to the contract was to sling 1,000 pounds of lumber to a fishing lodge 3 miles down a lake. Weather was overcast with a high ceiling and minus 15 degrees Celsius. I had a 2 day layoff and was keen to do this job. At the sling site I briefed the people on the ground, and told them that I will try to lift the load in one shot due to the high winds helping me, and also to save money. I hooked up on a 10-foot line and was off at 92% torque. Climbing to a safe altitude I turned downwind to the right looking through the window for the drop site. Half way into the turn I could feel a yaw and a second later the low rotor horn was on. Lowering the collective and looking for a spot to land, the horn stopped and my rotor rpm was returning, only to decay on any large collective input. Doing a throttle open check and not having success, I found that I could descend on a gentle glide slope, and flew a no-hover landing to the water (on floats). Hovering with the load floating, and 65% torque, my rotor began to droop. I towed the load to shore, and released to land on the beach to inspect the aircraft. On inspection of the FCU max stop, I could see a small gap existed between the stop screw and the arm, with the throttle full open.*

I fired up once again, hooked up my load and pulled power. At high torque with the rotor drooping I squeezed the throttle open with more than normal twist, to have my rotor rpm return. After adjusting the FCU, the only reason I could think of for this problem was that the FCU was rigged very close to the max of the twist grip throw, and with a 17 degree OAT change from the last flight two days previous, a small linkage change had occurred, causing the gap, and the rpm loss at high torque.

I'm glad I had lots of time, and room to land the load, my finger was on the button."

** Fuel Control Unit*

206L Lightning?

"It was September, during the monsoon season in Arizona. I was at approximately 800 feet AGL in the late afternoon. There was some weather in the area but I was clear of the buildups, but was experiencing some turbulence in wind gusts.

Something unusual happened. Suddenly I was experiencing severe moderate frequency vibrations. My first thought was that it was a control system problem or main rotor system failure.

I lowered the collective and the vibrations subsided. I had already decided to make a precautionary landing and had selected a place to land. Engine turbine temperature indication was high - 800 degrees, and fluctuating plus and minus 50 degrees.

With the power down the oscillations were minimal. When I added power for landing the high oscillations returned. I think they were rapid compressor stalls. On short final I rolled the throttle off and touched down without a problem.

There I Was... pg. 4 cont'd.

After I was shutdown some kids came running up to the helicopter. They asked, "Did you get hit by lightning?" I didn't think much about it. I had not seen any flash or heard any accompanying sound.

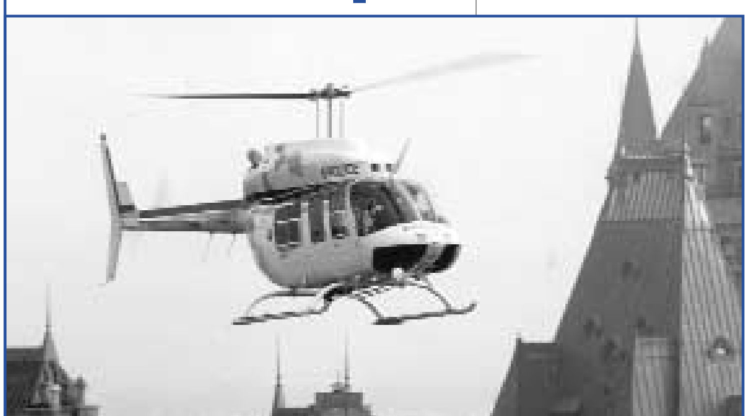
A newspaper later reported that the helicopter that made the precautionary landing - my helicopter - was the one that had been struck by lightning.

The next day the helicopter was loaded on a flatbed and trucked out.

When the aircraft was inspected the engine had holes in the bottom of the compressor casing. It looked as if someone had arc-welded through the casing. Further tests gave mixed results. Some said it was lightning that had pitted the bearings in the recently overhauled transmission - it had only a few hours on it. Before my flight the engine had been power checked and showed to be a healthy +20 engine.

Until quite a few weeks after the incident I did not believe it was a lightning strike. I saw no flash, heard no thunder, or sensed no "crackle." I had no obvious indications that it was a lightning strike. Apparently during the investigation witnesses who were questioned claimed that they observed lightning had struck my helicopter.

Be aware of lightning. It can hit you, and it can take your helicopter out of the sky."



Hidden Hangover

By Lt. Heidi Squier, MSC

It's 0100 at the O Club. A hail and farewell has continued into the night, but our aviator knows he will not brief his flight until 1400 the next day. "More than 12 hours bottle to brief," he thinks, as he declines a beer and orders a glass of water. He gets a room at the BOQ so he doesn't have to drive. After checking in, he forces down some more water, and goes to sleep.

By 1400 the next day, our hero feels fine. The water he drank did the job of hydrating away his hangover symptoms. He arrives for his brief apparently in good shape. His flight goes fine... until he enters IMC. Before he can transition to instruments, he becomes aware of a sickening, spinning sensation. His copilot takes the controls and lands. However, our aviator is confused, as well as nauseated.

"These symptoms can't have anything to do with the night before," he thinks. "It's been more than 12 hours since my last drink. NATOPS and 3710 both say I can fly."

He can... but should he?

His problem is in his vestibular apparatus, which lies buried within the inner ear and has tiny hair cells that stick into a jelly-like fluid. When the aviator turns or accelerates, this fluid moves opposite the direction of his motion, deflecting the hair cells and telling which end is up. These hair cells are great inventions but are not intended to function without input from his eyes, ears, and brain. If any of these components are impaired, a mismatch occurs, and he feels sick.

Alcohol displaces part of the fluid in the inner ear, making the tiny hair cells hypersensitive to any movement, almost as if they were sunburned. When you go out drinking and later lie down in a quiet room and close your eyes, you shut several other components out of the equilibrium system. The hypersensitive cells then make it seem like the room is spinning.

How does alcohol affect you in flight? It can take 24-48 hours for the alcohol in your inner ear to dissipate, despite a 0.0 BAC. It may still be there when you fly into the clouds. Since the hair cells are "sunburned," the false sensation could disorient you. In the case of this pilot, he wanted to transition to instruments and thus cut his eyes out of the equation.

The bottle-to-brief rule was developed for good reasons and has worked for a long time. But there is another good rule of thumb for aircrew: if you're not sure of your ability to fly safely on the morning after, sit down and put your head between your knees. Rapidly sit up. If you get dizzy or feel sick, you might still have alcohol on board, buried within your inner ear. Remember how it feels to "spin" and decide whether to take that chance in the cockpit.

Naval Safety Center
Approach Magazine

FAR 91.17. No person may act or attempt to act as a crewmember of a civil aircraft - within 8 hours after consumption of any alcoholic beverage - while under the influence of alcohol - while having a .04 percent by weight or more alcohol in the blood.

YOUR ANSWERS. . . . .

In the last issue we asked "Under what circumstances do you refer to the performance and flying qualities charts in you Flight Manual? Which charts do you use?"

Here are some of your answers.
Human AD.

Editor's Note

In the last issue we published several responses that addressed the in-flight procedures pilots would perform after losing external visual references.

One of those responses drew comments from a number of readers. Those comments can be summarized as: "Does someone really do that?" They were commenting on the procedure that described: "Drop the Collective, back on the cyclic. Right pedal..."

Another reader suggested we were remiss in allowing such a response - serious or not - to be published without editorial comment. The suggestion is accepted.

An editorial comment should have been there. At a minimum we should have said: "Before you put this procedure in your tool box, you had better understand what it is."

We do not publish all the responses we receive. Those selected will, in our opinion, stimulate thought, provide some different ideas, and generally show the spectrum of thinking resident in the operational world. Part of the rationale is to show that there are perceptions, assumptions, and expectations held by active operational helicopter pilots that may be inaccurate, incomplete, or simply wrong.

We recognize that some of the responses we publish may be radical, and contrary to prudent judgement. We'll be more careful to highlight those responses.

A standing editorial comment will always apply to the unedited and usually anonymous responses we receive in reply to our "What's your Answer?" question. It is:

Be careful in reading the answers to our questions. They may be wrong!

"We refer to the out of ground effect charts anytime we land in an unprepared landing zone, especially during the summer months. As an EMS provider, our operations frequently take us to altitudes above 11,000 feet with landings in the mountains above 10,000 feet."

"Under all circumstances, before each flight - W+B, HOGE, HIGE, Max Manifold Pressure (for that day), Vne speed max related to Temperature + Pressure Altitude. Robinson R-22."
(We interpret W+B to mean Weight and Balance. Editor.)

"Whenever I have a mission that will require operating up at altitude I will check the HOGE/HIGE charts."

"When engine performance is questionable, i.e. engine performance seems not to meet the minimum specification for that engine then we have to perform a power assurance check. We use the power assurance chart."

"If I change my area of operation, or the ambient conditions change significantly in my area of operations I will refer to the Hover Charts, Rate of Climb Charts, and Critical Wind Azimuth Chart to see what I should expect. If I remain in my area of operations, and ambient conditions (Density Altitude, Temperature) remain relatively unchanged I do not look at the charts."

"Of course we keep track of weight more than anything else. We start with an operating weight - basic weight plus pilot - and then balance

fuel, passengers, and cargo. It's simple addition to know what the takeoff weight is. We also pay attention to CG. We use simple rules to balance baggage compartment weight with cabin weight, and to seat passengers left and right to avoid lateral CG problems. We don't routinely refer to the charts however."

"As a sea level driver about the only chart I look at is the power assurance chart. I keep track of weight, and use common sense in placing people and loads in the cabin."

"I don't very often refer to any charts. But recently I was to fly the 206L4 with one of my fellow pilots. He would be in the left seat. We are each mature adults (both of us are significantly heavier than 200 pounds). We had only 350 pounds of fuel. It looked like we had a chance to be at or beyond the forward CG limit. I did a quick calculation and sure enough, we would be outside the forward limit. We put a 50 pound weight in the baggage compartment."

"In my everyday routine flying I rarely use any charts in the flight manual. That does not mean that I am not attentive to weight and balance and ambient conditions and loads that would affect performance. When I do something different, such as fly a new aircraft at a different location I'll check whatever chart is pertinent."

"About the only charts I look at in my operation are the power assurance and hover charts."

Here are a few late responses to questions in earlier issues.

"1. Stay Calm. 2. Begin Instrument scan. 3. Establish a standard rate turn away from any known obstacles or terrain - 180 degree and go back to VFR. If this is not successful - fly a heading with lower terrain ahead. Maintain altitude and advise ATC of your emergency!"

"Flying in mountains over a valley during winter at a temp of 0 to 10 degrees C under a low layer of clouds. I was surprised by a freezing rain which covered my front windshield. Knowing the area well I managed to land safely looking through my right window."

"I was long-lining in Ecuador at 3,000 feet in a Bell 205. It was for seismic work on a 150 foot line. The turbulence was so severe I had to jettison the load."

"Ground crew rigged cement mixer with CG above lifting eyes. As the load passed over mountain top, the mixer flipped over, breaking 2 of the 4 legs and causing a tremendous jolt and vibration through the airframe. landed with no further damage - except to the seat cushion.

Reporting an Accident to the NTSB

The pilot/operator of an aircraft shall file a report with the Field Office of the National Transportation Safety Board nearest the accident or incident. A phone call is sufficient initially, but a written follow-up on NTSB Form 6120.1/2 shall be filed within ten days after an accident for which notification is required.

"Aircraft Accident" means an occurrence with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all persons have disembarked, and in which any person suffers death, or serious injury as a result of being in or upon the aircraft or in direct contact with the aircraft or anything attached thereto, or in which the aircraft receives substantial damage.

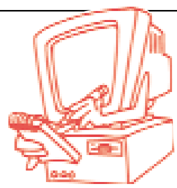
"Substantial Damage" means damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.

NOTE: Engine failure (damage limited to the engine), bent fairing or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage" for purposes of this report

WHAT'S YOUR ANSWER ?

QUESTION:

What checklists do you use? What format are the checklists in, and how do you handle them?



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The primary objective of the HELIPROPS program and the ***HUMAN AD*** is to help reduce human error related accidents. This newsletter stresses professionalism, safety and good aeronautical decision-making.

Letters with constructive comments and suggestions are invited. Correspondents should provide name, address and telephone number to:

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